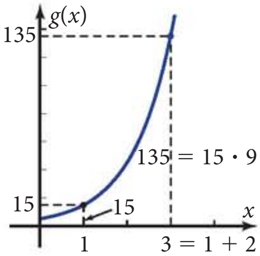


Exponential function

	x	g(x)	
	1	15	
+2	3	135	×9
+2	5	1215	×9
+2	7	10935	×9

The add-multiply property

Figure 2-3b

The Add–Multiply Pattern of Exponential Functions

Figure 2-3b shows the graph of the exponential function $g(x) = 5 \cdot 3^x$. This time, adding 2 to x results in the corresponding $g(x)$-values being *multiplied* by the constant 9. This is not coincidental. Here's why the pattern holds.

$$g(1) = 5 \cdot 3^1 = 15$$

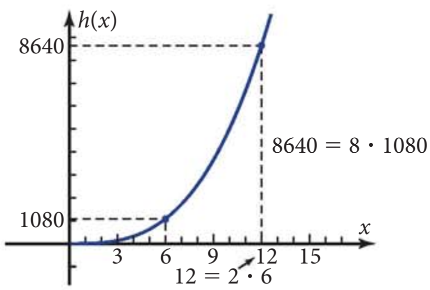
$$g(3) = 5 \cdot 3^3 = 135 \qquad \text{(which equals 9 times 15)}$$

You can see algebraically why this is true.

$$\begin{aligned} g(3) &= 5 \cdot 3^3 \\ &= 5 \cdot 3^{1+2} && \text{Write the exponent as 1 increased by 2.} \\ &= 5 \cdot 3^1 \cdot 3^2 && \text{Product of powers with equal bases property.} \\ &= (5 \cdot 3^1) \cdot 3^2 && \text{Associate 5 and } 3^1 \text{ to get } g(1) \text{ in the expression.} \\ &= g(1) \cdot 9 \end{aligned}$$

The conclusion is that if you add a constant to x, the corresponding y-value is multiplied by the base raised to that constant. This is called the **add–multiply property** of exponential functions.

The Multiply–Multiply Pattern of Power Functions



Power function

	x	g(x)	
	3	135	
×2	6	1080	×8
×2	9	3645	×8
	12	8640	

Ignore $x = 9$.

The multiply-multiply property

Figure 2-3c

Figure 2-3c shows the graph of the power function $h(x) = 5x^3$. As shown in the table, adding a constant, 3, to x does *not* create a corresponding pattern.

However, a pattern *does* emerge if you pick values of x that change by being *multiplied* by a constant.

$$h(3) = 5 \cdot 3^3 = 135$$

$$h(6) = 5 \cdot 6^3 = 1080 \qquad \text{(which equals 8 times 135)}$$

$$h(12) = 5 \cdot 12^3 = 8640 \qquad \text{(which equals 8 times 1080)}$$